

Methods and Apparatus for Generating Strongly-Ionized Plasmas with Ionizational Instabilities

Abstract

Methods and apparatus for generating strongly-ionized plasmas are disclosed. A strongly-ionized plasma generator according to one embodiment includes a chamber for confining a feed gas. An anode and a cathode assembly are positioned inside the chamber. A pulsed power supply is electrically connected between the anode and the cathode assembly. The pulsed power supply generates a multi-stage voltage pulse that includes a low-power stage with a first peak voltage having a magnitude and a rise time that is sufficient to generate a weakly-ionized plasma from the feed gas. The multi-stage voltage pulse also includes a transient stage with a second peak voltage having a magnitude and a rise time that is sufficient to shift an electron energy distribution in the weakly-ionized plasma to higher energies that increase an ionization rate which results in a rapid increase in electron density and a formation of a strongly-ionized plasma.